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Title

Spatiotemporal Analyses of Water Quality and Vegetation Growth in Coal Mine Areas in Eastern Kentucky

Abstract

Kentucky is the third-largest coal-mine producer in the US. Coal production brings money as well as environmental impact to the state. Major impacts of surface coal mining are valley fills, acid drainage, natural land cover loss, hydrological pattern change and water quality degradation. This study aims to measure historical areal mining extent with remote sensing and analyze vegetation growth in mined and unmined sub-watersheds along with coal mine related water qualities (SO_4^{-2}, Alkalinity, Electrical Conductivity, Ca^{++}, Mg^{++}, Mn, Al, Fe). The study has been conducted in 27 sub-watersheds of Johnson Creek and Troublesome Creek watersheds in Perry, Magoffin, Knott, and Breathitt counties. We utilized 4-year interval Landsat images between 1986-2016 to extract composite classified NDVI maps. Then, we measured vegetation change from these maps. Beside remotely acquired data, water samples collected at drainage exit points of the sub-watersheds and analyzed for the water quality parameters. Pearson bivariate correlation analysis was performed among areal mining extent, water quality parameters, and reclamation age. We found high correlation between percentage of areal mining extent for watersheds and SO_4^{-2}, Alkalinity, Electrical Conductivity, Ca^{++}, Mg^{++}. Adjusted areal mining extent according to vegetation growth made the relationship stronger with the same parameters. We also found very strong correlation between age of reclamation and percentage of reclaimed forest.

Presenters: Mr. Oguz Sariyildiz, Dr. Buddhi Gyawali, Mr. Jeremy Sandifer, Dr. Tilak Shresta,

        Ms. Prabisha Shresta

Organization: Kentucky State University

Contact Info: Kentucky State University

        Coop Ext Bldg., 400 East Main Street,

        Frankfort, Ky 40601

        oguz.sariyildiz@kysu.edu, buddhi.gyawali@kysu.edu

        859-317-3101